

Desmosome

Introduction

Desmosomes are adhesive intercellular junctions that mechanically integrate adjacent cells by coupling adhesive interactions mediated by desmosomal cadherins to the intermediate filament cytoskeletal network. Desmosomal cadherins are connected to intermediate filaments by densely clustered cytoplasmic plaque proteins.

The importance of desmosomes in tissue integrity is highlighted by human diseases caused by mutations in desmosomal genes, autoantibody attack of desmosomal cadherins, and bacterial toxins that selectively target desmosomal cadherins.

Desmosome Structure and Morphology

Desmosomes are specialized and highly ordered membrane domains that mediate cell-cell contact and strong adhesion.

Adhesive interactions at the desmosome are coupled to the intermediate filament cytoskeleton. By mediating both cell–cell adhesion and cytoskeletal linkages, desmosomes mechanically integrate cells within tissues and thereby function to resist mechanical stress.

This essential structural and mechanical function is highlighted by the prominent distribution of desmosomes in tissues that are routinely subjected to physical forces, such as the heart and skin, and the wide range of desmosomal diseases that result from disruption of desmosome function.

At the ultrastructural level, desmosomes appear as electron dense discs approximately 0.2–0.5 μm in diameter, which assemble into a mirror image arrangement at cell–cell interfaces.

Large bundles of intermediate filaments extend from the nuclear surface and cell interior out toward the plasma membrane, where they attach to desmosomes by interweaving with the cytoplasmic plaque of the adhesive complex.

The overall adhesive function of the desmosome is dependent upon the tethering of intermediate filaments to the desmosomal plaque, highlighting the integrated functions of adhesion and cytoskeletal elements.

Thus, desmosomes are modular structures comprising adhesion molecules that bolt (tightens) cells together, cytoskeletal cables that disperse forces, and linking molecules at the cytoplasmic plaque of the desmosome that carry mechanical load from the adhesion molecules to the intermediate filament cytoskeleton.

Functions of desmosomes

1. Strong mechanical adhesion for integrating cells together (cell–cell adhesion & cytoskeletal linkages).
2. Works like bolts between two adjacent cells.
3. Resist mechanical stress within tissues.

Desmosome Molecular Composition

Three major gene families encode desmosomal proteins. Desmosomal cadherins, comprising two subtypes called desmogleins and desmocollins, are a subfamily of the cadherin superfamily that mediate calcium-dependent cell–cell adhesion.

